



L1B Quality Assessment Discussion

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AIRS L1B QA OVERVIEW



- **Types of data in L1B QA Files**
 - ***Data passed from L1A intended for L2 use (e.g. geolocation)***
 - Validated using earth scene geolocation software post launch
 - **Radiometric QA**
 - Looks at noise, popping, DCR, critical calibration temperatures
 - Scan by scan summary of radiometric quality in CalFlag
 - **Spectral QA**
 - Grating model parameters, centroids for all channels
 - Granule level summary by channel in CalChanSummary
 - **Spatial QA**
 - Scene nonhomogeneity indicators for every footprint
- **Software in place to aggregate QA files for “Daily” summary (or other timeframe if desired)**
- **Text Summary and Display tools in progress**



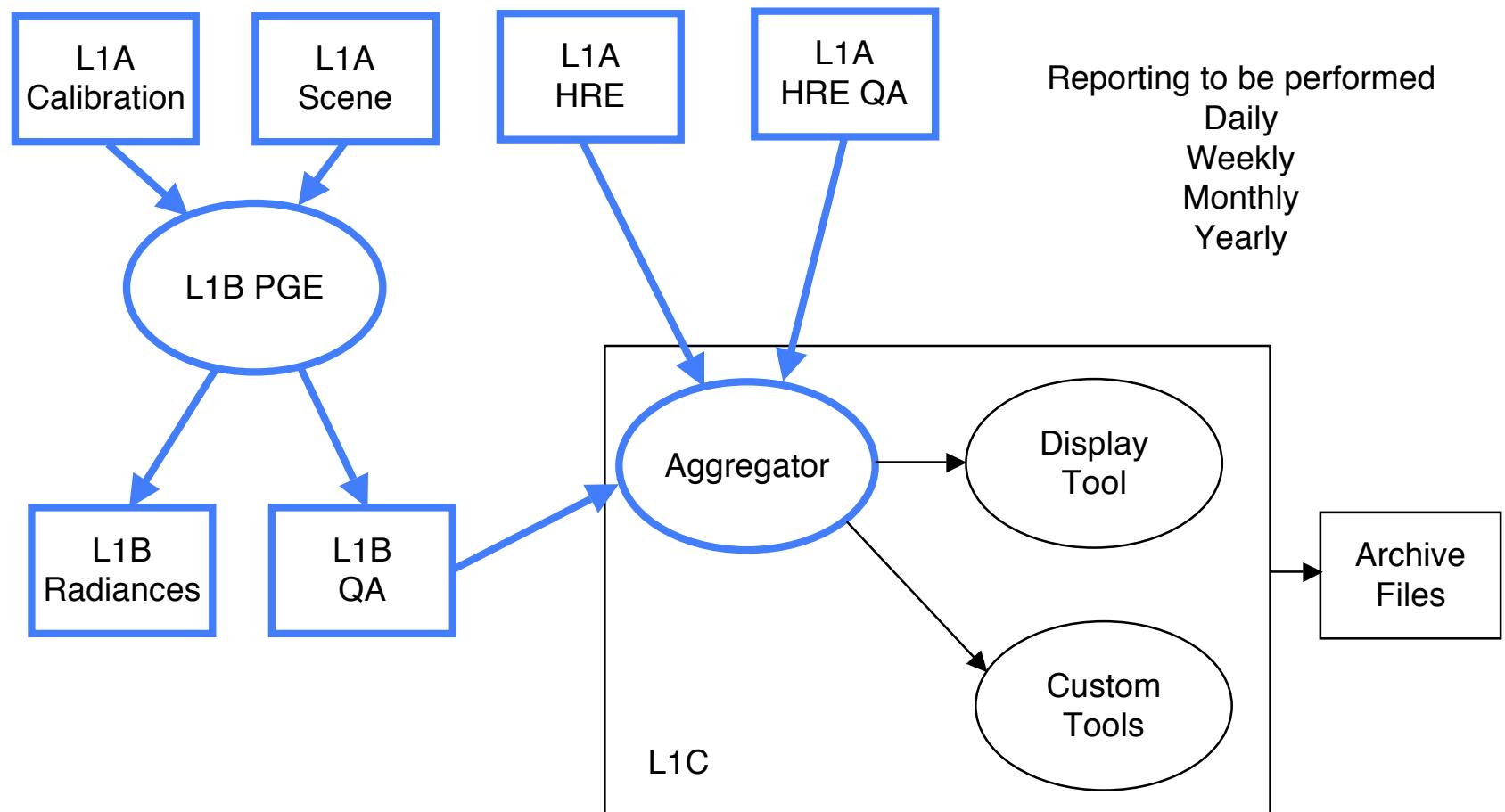
AIRS HRE TELEMETRY TRENDING PLAN MONITORS AIRS HEALTH AND STATUS



- 901 AIRS telemetry parameters monitored in orbit
 - *L1A PGE performs limit checking on these parameters based on limit table provided by engineering team*
 - *Tables and L1A PGE in place now to perform this function*
 - *Results placed in L1A HRE QA file*
- Software in place to:
 - *Aggregate L1A and L1B files for daily composite*
- Software under development to:
 - *Read file and look for violations*
 - *Trend and plot desired telemetry parameters in various formats (e.g. time histories, global trending etc.)*
 - *Tells us what the AIRS setup is at any given time*
 - *Software will be modification of existing TVAC software*
- HRE Telemetry monitoring starts at L+15, trending starts at L+60



L1A HRE and L1B QA Trending Architecture



Per Granule Data Fields

L1B QA Parameters

Primarily From L1A

Name	Section
processing_level	Fixed
instrument	Fixed
DayNightFlag	1A
AutomaticQAFlag	4.2
NumTotalData	4.2
NumProcessData	4.2
NumSpecialData	4.2
NumBadData	4.2
NumMissingData	1A
NumLandSurface	1A
NumOceanSurface	1A
node_type	1A
start_year	1A
start_month	1A
start_day	1A
start_hour	1A
start_minute	1A
start_sec	1A
start_orbit	
end_orbit	
orbit_path	
granule_number	
num_scansets	
num_scanlines	
start_Latitude	1A
start_Longitude	1A
start_Time	1A
end_Latitude	1A
end_Longitude	1A
end_Time	1A
eq_x_longitude	1A
eq_x_tai	1A
orbitgeoqa	
num_satgeoqa	1A
num_glintgeoqa	1A
num_moongeoqa	1A
num_ftptgeoqa	1A
num_zengeoqa	1A
num_demgeoqa	1A
num_fpe	1B
LonGranuleCen	1A
LatGranuleCen	1A
LocTimeGranuleCen	1A
granules_present	1A

Primarily Radiometric

Name	Section
CalGranSummary	4.2
CalChanSummary	4.2
ExcludedChans	4.2
NeN	6.5.3
DCR_scan	6.2.3
input_scene_counts	6.1.3
input_space_counts	6.2.3
input_space_diffs	6.2.3
input_bb_counts	6.4.3
input_spec_counts	6.4.3
input_bb_temp	6.4.3
input_bb_temp1	6.4.3
input_bb_temp2	6.4.3
input_bb_temp3	6.4.3
input_bb_temp4	6.4.3
input_spec_temp	5
input_ir_det_temp	5
input_grating_temp_1	5
input_grating_temp_2	5
input_entr_filt_temp	5
input_opt_bench_temp_2	5
input_opt_bench_temp_3	5
input_scan_mirror_temp	5
input_chopper_phase_err	5
PopCount	N/A
offset_stats	6.2.3
gain_stats	6.4.3
rad_stats	6.1.3
NumRefChannels	9
RefChannels	9
rad_scan_stats	6.1.3
DCRCount	N/A

Primarily Spatial

cij_window_M1a_chan	8
cij_window_M2a_chan	8
cij_water_M8_chan	8
cij_water_M9_chan	8
cij_CO2_R_Branch_M2b_chan	8
cij_CO2_R_Branch_M1b_chan	8

Primarily Spectral

Name	Section
spectral_TAI	7.1.6
spectral_TAI_prev	7.1.6
nominal_freq	7.1.6
spectral_freq	7.1.6
spectral_freq_unc	7.1.6
spectral_freq_prev	7.1.6
spectral_freq_prev_unc	7.1.6
spec_shift_upwell	7.1.5
spec_shift_unc_upwell	7.1.5
spec_fl_upwell	7.1.5
spec_fl_unc_upwell	7.1.5
SpectralFeaturesUpwell	7.1.2
spec_feature_shifts_upwell	7.1.4
spec_feature_corr_upwell	7.1.4
spec_feature_sharp_upwell	7.1.4
spec_feature_resid_upwell	7.1.5
spec_iter_upwell	7.1.5
spec_feature_contrast_stats	7.1.4
spec_clim_select	5
spec_shift_pary	5
spec_shift_unc_pary	5
spec_fl_pary	5
spec_fl_unc_pary	5
SpectralFeaturesPary	7.2.1
spec_feature_shifts_pary	7.2.3
spec_feature_corr_pary	7.2.3
spec_feature_sharp_pary	7.2.3
spec_feature_resid_pary	7.2.4
spec_iter_pary	7.2.4
ave_pary_spectrum	7.2.2

Per Scan Data Fields

Name	Section
satheight	1A
satroll	1A
satpitch	1A
satyaw	1A
satgeoqa	1A
glintgeoqa	1A
moongeoqa	1A
nadirTAI	1A
sat_lat	1A
sat_lon	1A
scan_node_type	1A
glintlat	1A
glintlon	1A
CalScanSummary	4.2
CalFlag	4.2
SpaceViewDelta	6.2.3
spaceview_selection	6.2.3

Per Footprint Data Fields

Name	Section
scanang	1A
ftpgeoqa	1A
zengeoqa	1A
demgeoqa	1A
satzen	1A
satazi	1A
solzen	1A
solazi	1A
sun_glint_distance	1A
topog	1A
topog_err	1A
landFrac	1A
landFrac_err	1A
state	4.2
cij_window	8
cij_water	8
cij_CO2_R_Branch	8
Scenelnhomogeneous	8

The requirement for the parameter can be found in the section after each QA parameter in the **L1B Requirements Document**:

“Atmospheric Infrared Sounder (AIRS), Level 1B Visible, Infrared and Telemetry Algorithms and Quality Assessment (QA) Processing Requirements”, June 22, 2001, Version 1.0, ADF 525



CAL FLAGS ARE KEY TO IDENTIFYING VALID DATA



- **AUTOMATIC QA FIELD**
 - *Determines overall quality of a granule based on state*
 - *Depends on state flag which says if data are valid or invalid and identifies valid and invalid conditions of CalGranSummary*
- **CAL_FLAG FIELDS**
 - *Provide necessary information on the calibration*
 - *bitfield: Gains, offsets, noise events, saturation, spectral*

Summary Level	QA Name	Number Per Granule
Granule	CalGranSummary	1
Channel	CalChanSummary	N_{chan}
Scan	CalScanSummary	N_{scan}
Scans & Channels	CalFlag	$N_{chan} \times N_{scans}$

- *Must also monitor “state” flag per footprint for missing/bad data*



CALIBRATION FLAG DETAILS

Cal Flag (2378 / Scan)

Bit	Name	How Set (Per scan decision)	Dependency
7	scene	overflow/underflow on scene occurred	90 earthview dn's per scan
6	offset	overflow/underflow on SV occurred	4 spaceview dn's per scan
5	gain	overflow/underflow on OBC BB view occurred	BB dn per scan out of limits.
4	pop detected	SpaceViewDelta exceeds N_width_report * NEdN	SpaceViewDelta
3	DCR Occurred	Apply high to this bit for scan in granule identified by DCR_scan	DCR_scan
2	Moon in View	Flag as defined in section 6.2.1.4	spaceview_selection
1	telemetry	Out of limit condition for telemetry in Table 5	See Table 5
0	Reserved		

CalScanSummary (1 / Scan) = "or" over "Good" Chans

CalChanSummary (2378 / Granule) CalGranSummary (1 / Granule) = "or" over "Good" Chans

Bit	Name	How Set (Per granule)	Dependency
7	scene	overflow/underflow on scene occurred	input_scene_counts
6	offset	overflow/underflow on SV occurred	input_space_counts
5	gain	overflow/underflow on OBC BB view occurred, BB temperature out of range, BB side error	input_bb_counts, input_bb_temp, bb_temp_side
4	pop detected	max of input_space_diff exceeds N_width_report. x NE_DN.	input_space_diff
3	high noise	NEN Exceeds Limits for granule	NEN
2	spectral bad	Spectral fit failed or fit residuals too high	See sections 7.1.5.3 and 7.1.5.4
1	telemetry	Out of limit condition for telemetry in Table 5	See Table 5
0	Reserved		



L1B MONITORING IN-FLIGHT BY ACT



- L1B Starts flowing in FL+70 (After Special Tests and Stabilization)
- QA will be tracked and debugged during this time
 - *Temperature limits updated*
 - *Cal Flag limits updated*
 - *Spectral and Radiometric algorithms checked for robustness*
 - *DCR evaluated*
 - *Effects of moon in space viewport evaluated*
- Scene Radiances will be evaluated
 - *Correlated noise, fixed pattern or 1/f noise*
 - *Scan Angle Dependence (Polarization Effects, Mirror contamination (if any), etc.)*
 - *Climatologies selected for spectral calibration*



TIMELINE ASSUMPTIONS AND CONCLUSIONS



- **Timeline Assumptions**
 - *Orbit achieved in time expected*
 - *First outgassing exercise is sufficient and no others are required*
 - *Orbital yaw maneuvers completed prior to calibration*
 - *No deep space maneuver*
- **Conclusions**
 - *Operational timeline in place.*
 - *Calibration sequences a key part of evaluation phase*
 - ***ACT Ready to***
 - Transfer calibration to in-orbit environment
 - Monitor and trend AIRS calibration, health and status